
 $I(J^P) = \frac{1}{2}(\frac{1}{2}^+)$  Status: \*\*\*\*

The parity has not actually been measured, but + is of course expected.

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### $\Xi^0$ MASS

The fit uses the  $\Xi^0$ ,  $\Xi^-$ , and  $\Xi^+$  mass and mass difference measurements.

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
<b>1314.83±0.20 OUR NEW UNCHECKED FIT</b>	[ $1314.9 \pm 0.6$ MeV OUR 1998 FIT]			
<b>1314.82±0.20 OUR NEW AVERAGE</b>	[ $1314.8 \pm 0.8$ MeV OUR 1998 AVERAGE]			
1314.82±0.06±0.20	3120	FANTI	00	NA48 $p$ Be, 450 GeV
1315.2 ± 0.92	49	WILQUET	72	HLBC
1313.4 ± 1.8	1	PALMER	68	HBC

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### $m_{\Xi^-} - m_{\Xi^0}$

The fit uses the  $\Xi^0$ ,  $\Xi^-$ , and  $\Xi^+$  mass and mass difference measurements.

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
<b>6.48±0.24 OUR NEW UNCHECKED FIT</b>	[ $6.4 \pm 0.6$ MeV OUR 1998 FIT]			
<b>6.3 ± 0.7 OUR AVERAGE</b>				
6.9 ± 2.2	29	LONDON	66	HBC
6.1 ± 0.9	88	PJERROU	65B	HBC
6.8 ± 1.6	23	JAUNEAU	63	FBC
• • • We do not use the following data for averages, fits, limits, etc. • • •				
6.1 ± 1.6	45	CARMONY	64B	HBC See PJERROU 65B

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### $\Xi^0$ MEAN LIFE

VALUE ( $10^{-10}$ s)	EVTS	DOCUMENT ID	TECN	COMMENT
<b>2.90±0.09 OUR AVERAGE</b>				
2.83±0.16	6300	<sup>1</sup> ZECH	77	SPEC Neutral hyperon beam
2.88 <sup>+0.21</sup> <sub>-0.19</sub>	652	BALTAY	74	HBC 1.75 GeV/c $K^- p$
2.90 <sup>+0.32</sup> <sub>-0.27</sub>	157	<sup>2</sup> MAYEUR	72	HLBC 2.1 GeV/c $K^-$
3.07 <sup>+0.22</sup> <sub>-0.20</sub>	340	DAUBER	69	HBC
3.0 ± 0.5	80	PJERROU	65B	HBC
2.5 <sup>+0.4</sup> <sub>-0.3</sub>	101	HUBBARD	64	HBC
3.9 <sup>+1.4</sup> <sub>-0.8</sub>	24	JAUNEAU	63	FBC
• • • We do not use the following data for averages, fits, limits, etc. • • •				
3.5 <sup>+1.0</sup> <sub>-0.8</sub>	45	CARMONY	64B	HBC See PJERROU 65B

<sup>1</sup>The ZECH 77 result is  $\tau_{\Xi^0} = [2.77 - (\tau_\Lambda - 2.69)] \times 10^{-10}$  s, in which we use  $\tau_\Lambda = 2.63 \times 10^{-10}$  s.

<sup>2</sup>The MAYEUR 72 value is modified by the erratum.

## $\Xi^0$ MAGNETIC MOMENT

See the "Note on Baryon Magnetic Moments" in the  $\Lambda$  Listings.

VALUE ( $\mu_N$ )	EVTS	DOCUMENT ID	TECN
<b><math>-1.250 \pm 0.014</math> OUR AVERAGE</b>			
$-1.253 \pm 0.014$	270k	COX	81 SPEC
$-1.20 \pm 0.06$	42k	BUNCE	79 SPEC

## $\Xi^0$ DECAY MODES

Mode	Fraction ( $\Gamma_i/\Gamma$ )	Scale factor/ Confidence level
$\Gamma_1 \Lambda \pi^0$	$(99.51 \pm 0.05) \%$	S=1.2
$\Gamma_2 \Lambda \gamma$	$(1.18 \pm 0.30) \times 10^{-3}$	S=2.0
$\Gamma_3 \Sigma^0 \gamma$	$(3.5 \pm 0.4) \times 10^{-3}$	
$\Gamma_4 \Sigma^+ e^- \bar{\nu}_e$	$(2.7 \pm 0.4) \times 10^{-4}$	
$\Gamma_5 \Sigma^+ \mu^- \bar{\nu}_\mu$	$< 1.1 \times 10^{-3}$	CL=90%

$\Delta S = \Delta Q$  (SQ) violating modes or  
 $\Delta S = 2$  forbidden (S2) modes

$\Gamma_6 \Sigma^- e^+ \nu_e$	SQ	$< 9$	$\times 10^{-4}$	CL=90%
$\Gamma_7 \Sigma^- \mu^+ \nu_\mu$	SQ	$< 9$	$\times 10^{-4}$	CL=90%
$\Gamma_8 p \pi^-$	S2	$< 4$	$\times 10^{-5}$	CL=90%
$\Gamma_9 p e^- \bar{\nu}_e$	S2	$< 1.3$	$\times 10^{-3}$	
$\Gamma_{10} p \mu^- \bar{\nu}_\mu$	S2	$< 1.3$	$\times 10^{-3}$	

## CONSTRAINED FIT INFORMATION

An overall fit to 3 branching ratios uses 5 measurements and one constraint to determine 4 parameters. The overall fit has a  $\chi^2 = 4.2$  for 2 degrees of freedom.

The following *off-diagonal* array elements are the correlation coefficients  $\langle \delta x_i \delta x_j \rangle / (\delta x_i \cdot \delta x_j)$ , in percent, from the fit to the branching fractions,  $x_i \equiv \Gamma_i / \Gamma_{\text{total}}$ . The fit constrains the  $x_i$  whose labels appear in this array to sum to one.

$$\begin{array}{c|ccc} & & & \\ x_2 & -62 & & \\ x_3 & -78 & 0 & \\ x_4 & -8 & 0 & 0 \\ & x_1 & x_2 & x_3 \end{array}$$

$\Xi^0$  BRANCHING RATIOS $\Gamma(\Lambda\gamma)/\Gamma(\Lambda\pi^0)$  $\Gamma_2/\Gamma_1$ 

<u>VALUE</u> (units $10^{-3}$ )	<u>EVTS</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
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**1.19±0.30 OUR NEW UNCHECKED FIT** Error includes scale factor of 2.0.  $[(1.06 \pm 0.16) \times 10^{-3}$  OUR 1998 FIT]

**1.19±0.30 OUR NEW AVERAGE** Error includes scale factor of 2.0.  $[(1.06 \pm 0.16) \times 10^{-3}$  OUR 1998 AVERAGE]

$1.91 \pm 0.34 \pm 0.19$	31	<sup>3</sup> FANTI	00	NA48 $p$ Be, 450 GeV
$1.06 \pm 0.12 \pm 0.11$	116	JAMES	90	SPEC FNAL hyperons

<sup>3</sup>FANTI 00 used our 1998 value of 99.5% for the  $\Xi^0 \rightarrow \Lambda\pi^0$  branching fraction to get  $\Gamma(\Xi^0 \rightarrow \Lambda\gamma)/\Gamma_{\text{total}} = (1.90 \pm 0.34 \pm 0.19) \times 10^{-3}$ . We adjust slightly to go back to what was directly measured.

 $\Gamma(\Sigma^0\gamma)/\Gamma(\Lambda\pi^0)$  $\Gamma_3/\Gamma_1$ 

<u>VALUE</u> (units $10^{-3}$ )	<u>EVTS</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
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**3.5 ±0.4 OUR NEW UNCHECKED FIT**  $[(3.6 \pm 0.4) \times 10^{-3}$  OUR 1998 FIT]

**3.5 ±0.4 OUR NEW AVERAGE**  $[(3.6 \pm 0.4) \times 10^{-3}$  OUR 1998 AVERAGE]

$3.16 \pm 0.76 \pm 0.32$	17	<sup>4</sup> FANTI	00	NA48 $p$ Be, 450 GeV
$3.56 \pm 0.42 \pm 0.10$	85	TEIGE	89	SPEC FNAL hyperons

<sup>4</sup>FANTI 00 used our 1998 value of 99.5% for the  $\Xi^0 \rightarrow \Lambda\pi^0$  branching fraction to get  $\Gamma(\Xi^0 \rightarrow \Sigma^0\gamma)/\Gamma_{\text{total}} = (3.14 \pm 0.76 \pm 0.32) \times 10^{-3}$ . We adjust slightly to go back to what was directly measured.

 $\Gamma(\Sigma^+ e^- \bar{\nu}_e)/\Gamma_{\text{total}}$  $\Gamma_4/\Gamma$ 

<u>VALUE</u> (units $10^{-4}$ )	<u>EVTS</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
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**2.7 ±0.4 OUR FIT**

**2.71±0.22±0.31** 176 AFFOLDER 99 KTEV  $p$  nucleus 800 GeV

 $\Gamma(\Sigma^+ \mu^- \bar{\nu}_\mu)/\Gamma(\Lambda\pi^0)$  $\Gamma_5/\Gamma_1$ 

<u>VALUE</u> (units $10^{-3}$ )	<u>CL%</u>	<u>EVTS</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
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<1.1 90 0 YEH 74 HBC Effective denom.=2100

• • • We do not use the following data for averages, fits, limits, etc. • • •

<1.5	DAUBER	69	HBC
<7	HUBBARD	66	HBC

 $\Gamma(\Sigma^- e^+ \nu_e)/\Gamma(\Lambda\pi^0)$  $\Gamma_6/\Gamma_1$ 

Test of  $\Delta S = \Delta Q$  rule.

<u>VALUE</u> (units $10^{-3}$ )	<u>CL%</u>	<u>EVTS</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
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<0.9 90 0 YEH 74 HBC Effective denom.=2500

• • • We do not use the following data for averages, fits, limits, etc. • • •

<1.5	DAUBER	69	HBC
<6	HUBBARD	66	HBC

$\Gamma(\Sigma^-\mu^+\nu_\mu)/\Gamma(\Lambda\pi^0)$   
Test of  $\Delta S = \Delta Q$  rule.

$\Gamma_7/\Gamma_1$

VALUE (units $10^{-3}$ )	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
<0.9	90	0	YEH	74	HBC Effective denom.=2500
$\bullet \bullet \bullet$ We do not use the following data for averages, fits, limits, etc. $\bullet \bullet \bullet$					
<1.5			DAUBER	69	HBC
<6			HUBBARD	66	HBC

$\Gamma(p\pi^-)/\Gamma(\Lambda\pi^0)$

$\Gamma_8/\Gamma_1$

$\Delta S=2$ . Forbidden in first-order weak interaction.

VALUE (units $10^{-5}$ )	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
< 3.6	90		GEWENIGER	75	SPEC
$\bullet \bullet \bullet$ We do not use the following data for averages, fits, limits, etc. $\bullet \bullet \bullet$					
<180	90	0	YEH	74	HBC Effective denom.=1300
< 90			DAUBER	69	HBC
<500			HUBBARD	66	HBC

$\Gamma(pe^-\bar{\nu}_e)/\Gamma(\Lambda\pi^0)$

$\Gamma_9/\Gamma_1$

$\Delta S=2$ . Forbidden in first-order weak interaction.

VALUE (units $10^{-3}$ )	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
<1.3			DAUBER	69	HBC
$\bullet \bullet \bullet$ We do not use the following data for averages, fits, limits, etc. $\bullet \bullet \bullet$					
<3.4	90	0	YEH	74	HBC Effective denom.=670
<6			HUBBARD	66	HBC

$\Gamma(p\mu^-\bar{\nu}_\mu)/\Gamma(\Lambda\pi^0)$

$\Gamma_{10}/\Gamma_1$

$\Delta S=2$ . Forbidden in first-order weak interaction.

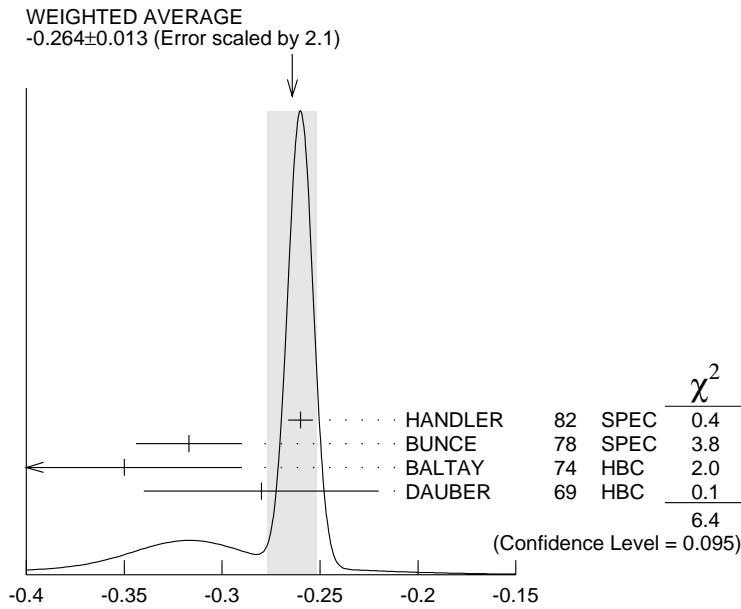
VALUE (units $10^{-3}$ )	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
<1.3			DAUBER	69	HBC
$\bullet \bullet \bullet$ We do not use the following data for averages, fits, limits, etc. $\bullet \bullet \bullet$					
<3.5	90	0	YEH	74	HBC Effective denom.=664
<6			HUBBARD	66	HBC

## $\Xi^0$ DECAY PARAMETERS

See the "Note on Baryon Decay Parameters" in the neutron Listings.

$\alpha(\Xi^0) \alpha_-(\Lambda)$

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
<b><math>-0.264 \pm 0.013</math> OUR AVERAGE</b>		Error includes scale factor of 2.1. See the ideogram below.		
-0.260 $\pm 0.004 \pm 0.005$	300k	HANDLER	82	SPEC FNAL hyperons
-0.317 $\pm 0.027$	6075	BUNCE	78	SPEC FNAL hyperons
-0.35 $\pm 0.06$	505	BALTAY	74	HBC $K^- p$ 1.75 GeV/c
-0.28 $\pm 0.06$	739	DAUBER	69	HBC $K^- p$ 1.7–2.6 GeV/c



$$\alpha(\Xi^0)\alpha_-(\Lambda)$$

### $\alpha$ FOR $\Xi^0 \rightarrow \Lambda\pi^0$

The above average,  $\alpha(\Xi^0)\alpha_-(\Lambda) = -0.264 \pm 0.013$ , where the error includes a scale factor of 2.1, divided by our current average  $\alpha_-(\Lambda) = 0.642 \pm 0.013$ , gives the following value for  $\alpha(\Xi^0)$ .

VALUE	DOCUMENT ID
<b>-0.411 ± 0.022 OUR EVALUATION</b>	Error includes scale factor of 2.1.

### $\phi$ ANGLE FOR $\Xi^0 \rightarrow \Lambda\pi^0$

VALUE (°)	EVTS	DOCUMENT ID	TECN	COMMENT
<b>21 ± 12 OUR AVERAGE</b>				
16 ± 17	652	BALTAY	74	HBC    1.75 GeV/c $K^- p$
38 ± 19	739	<sup>5</sup> DAUBER	69	HBC
- 8 ± 30	146	<sup>6</sup> BERGE	66	HBC

<sup>5</sup> DAUBER 69 uses  $\alpha_\Lambda = 0.647 \pm 0.020$ .

<sup>6</sup> The errors have been multiplied by 1.2 due to approximations used for the  $\Xi$  polarization; see DAUBER 69 for a discussion.

### $\alpha$ FOR $\Xi^0 \rightarrow \Lambda\gamma$

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
<b>+0.43 ± 0.44</b>	87	JAMES	90	SPEC    FNAL hyperons

### $\alpha$ FOR $\Xi^0 \rightarrow \Sigma^0\gamma$

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
<b>+0.20 ± 0.32 ± 0.05</b>	85	TEIGE	89	SPEC    FNAL hyperons

## $\Xi^0$ REFERENCES

FANTI	00	EPJ C12 69	V. Fanti <i>et al.</i>	(CERN NA48 Collab.)
AFFOLDER	99	PRL 82 3751	A. Affolder <i>et al.</i>	(KTeV Collab.)
JAMES	90	PRL 64 843	C. James <i>et al.</i>	(MINN, MICH, WISC, RUTG)
TEIGE	89	PRL 63 2717	S. Teige <i>et al.</i>	(RUTG, MICH, MINN)
HANDLER	82	PR D25 639	R. Handler <i>et al.</i>	(WISC, MICH, MINN+)
COX	81	PRL 46 877	P.T. Cox <i>et al.</i>	(MICH, WISC, RUTG, MINN+)
BUNCE	79	PL 86B 386	G.R.M. Bunce <i>et al.</i>	(BNL, MICH, RUTG+)
BUNCE	78	PR D18 633	G.R.M. Bunce <i>et al.</i>	(WISC, MICH, RUTG)
ZECH	77	NP B124 413	G. Zech <i>et al.</i>	(SIEG, CERN, DORT, HEIDH)
GEWENIGER	75	PL 57B 193	C. Geweniger <i>et al.</i>	(CERN, HEIDH)
BALTAY	74	PR D9 49	C. Baltay <i>et al.</i>	(COLU, BING) J
YEH	74	PR D10 3545	N. Yeh <i>et al.</i>	(BING, COLU)
MAYEUR	72	NP B47 333	C. Mayeur <i>et al.</i>	(BRUX, CERN, TUFTS, LOUC)
Also	73	NP B53 268 erratum	C. Mayeur	
WILQUET	72	PL 42B 372	G. Wilquet <i>et al.</i>	(BRUX, CERN, TUFTS+)
DAUBER	69	PR 179 1262	P.M. Dauber <i>et al.</i>	(LRL)
PALMER	68	PL 26B 323	R.B. Palmer <i>et al.</i>	(BNL, SYRA)
BERGE	66	PR 147 945	J.P. Berge <i>et al.</i>	(LRL)
HUBBARD	66	Thesis UCRL 11510	J.R. Hubbard	(LRL)
LONDON	66	PR 143 1034	G.W. London <i>et al.</i>	(BNL, SYRA)
PJERROU	65B	PRL 14 275	G.M. Pjerrou <i>et al.</i>	(UCLA)
Also	65	Thesis	Pjerrou	(UCLA)
CARMONY	64B	PRL 12 482	D.D. Carmony <i>et al.</i>	(UCLA)
HUBBARD	64	PR 135B 183	J.R. Hubbard <i>et al.</i>	(LRL)
JAUNEAU	63	PL 4 49	L. Jauneau <i>et al.</i>	(EPOL, CERN, LOUC+)
Also	63C	Siena Conf. 1 1	L. Jauneau <i>et al.</i>	(EPOL, CERN, LOUC+)